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by different persons. This variation was sometimes not less than three or four cubic inches; making it desirable to use some other bodies in place of the pepper seeds. Dr. Morton then tried leaden shot of the size called BB., measuring $\frac{1}{8}$ of an inch in diameter; which being perfectly smooth and spherical, of uniform size, and therefore not liable, like the seeds to variations from packing, were found to answer the purpose in every particular. In using the shot, it is necessary to fill the skull completely, by shaking it, and by pressing the shot down with the finger and the end of the funnel introduced into the foramen magnum, until all the cavities and sinuosities are filled. When this is accomplished, the shot being transferred to the tube, will give the capacity of the cranium in cubic inches, and with so much accuracy, that in six successive measurements of the same skull, the results did not vary more than half a cubic inch; a degree of accuracy which has not been attained by any former method. An experiment with the aparatus was then made, in the presence of the members, which corroborated the statements already made. Dr. Morton informed the Society, that he was now engaged in ascertaining by these means, the capacity of the cranium, as indicative of the size of the brain, in the different races of men; and will report the results for publication in the proceedings of the Academy.

STATED MEETING, April 13.

Vice President Morton in the Chair.

DONATIONS TO MUSEUM.

A specimen of Mountain Leather, from New Brunswick, N. Jersey.—From Dr. L. C. Beck.

Five specimens of Belemnites Americanus; three of Terebratula Sayi; seven fossil bones; the tooth of a Crocodile; two Shark's vertebræ, from the green sand formation of New Egypt, in N. Jersey.—From the Rev. James McFarland.

Two splendid specimens of the Phasianus Argus, (male and female,) from India.—From Dr. George C. Leib.

A branch of the Auracaria Chilensis, from Chili.—From Mr. J. Frampton Watson.

DONATIONS TO LIBRARY.

Journal of the Asiatic Society. (Nos. 16, 17, 18,) for 1840.—From Dr. Morton.

First Memoir on Porcelain Earths, by Alexander Brongniart.—From Dr. Morton.

View of the Soil and Climate of the United States, by C. F. Volney. 8vo. Philadelphia, 1804.—From Dr. Morton.

Bulletin of the National Institution. Washington, 1840.—From the Institution.

Annual Report of the Geology of Maryland, for 1840, by J. F. Ducatel.—from the Author.

Geological Survey of Michigan, for 1839 and 1840, by Dr. D. Houghton.—From the Author.

First and Second Annual Reports of the Geological Survey of Ohio, for 1838, by W. W. Mather.—From the Author.

Professor Johnson offered some observations on the Mechanical Structure of Coal, with evidences of the contemporaneous origin of its various kinds.

The question of the identity and contemporaneousness of the two great divisions of the coal measures of Pennsylvania, has sometimes occupied the attention of geologists. A similar question is occasionally agitated in Europe, in reference to the Anthracite and Bituminous coal fields of that quarter of the world.

Among the arguments in favour of the contemporaneous deposition of the coal in the two regions, those which are derived from the similarity of the accompanying measures or members of the coal series in the two regions, and the resemblance or identity of the fossil organic remains accompanying the coal in both cases, are not the least weighty. The presence of large bodies of carbonate of iron interposed among the coal beds in both coal districts, is an analogous circumstance strongly corroborative of the opinion that both varieties of coal were produced under circumstances at least strongly resembling each other.

Another circumstance favourable to the supposed similarity of circumstances which accompanied the deposition of anthracite and bituminous coal, is the resemblance in mechanical structure of the two kinds. This may, at the first enunciation, seem somewhat startling; especially since the terms heavy, hard and tough, are generally applied to the one, and light, soft and friable or tender, to the other. It is nevertheless true, that strong mechanical resemblances exist; and the more minutely we examine the two varieties, the more shall we be impressed with the conviction of the importance of the resemblance.

In the first place, the coal of all coal measures has a series of partings parallel to the floor or bottom of the bed on which it rests, and to the cover or roofing under which it lies. These are as distinct in inclined and vertical beds as in those which still remain horizontal.

In the second place, the connection between the coal and its underlying slate, as well as with its top slate, is so definite and well understood, that it serves to determine the true original position of coal beds, which have been so far disturbed as to be turned nearly upside down; of which examples are not wanting. These characteristics are found in beds of both kinds of coal.

In the third place, there is most commonly a fracture or division of the coal in some direction (which, for the same bed, is generally continuous,) and nearly at right angles to the planes of deposition.

Fourth, a third series of divisions by vertical planes, called cross partings, inclined to the last mentioned. This system of planes is not always continuous throughout the bed, but varies in the different plies.

The principal vertical divisions are known to miners by the names of " cleats" or " slines," and sometimes by that of " grains." The direction in which these run, seems to determine the manner of working out the coal; for in attempting to separate large masses from their natural position by means of wedges, it is only in the direction of the cleats that the separation can take place. In inclined beds, from which the coal is to be extracted by a *slope* or rail-road laid down on the floor of the bed, it is a great convenience to have the cleat lie in a direction diametrically across that of the slope, or in conformity with the *strike* of the bed; for then in running a drift from the bottom of the slope horizontally along the bed, and afterwards carrying the workings upward, the cleat will always face the miner, and he will be enabled to obtain heavy falls of coal by undermining and wedging down.

In most bituminous coals, and in not a few anthracites, the "cleavage of the laminæ," or what I have chosen to call surfaces of deposition, are sufficiently distinct, and afford ready partings to separate masses into small pieces. In some of the harder anthracites, however, these surfaces are nearly obliterated, being distinguishable only by different shades of black. The actual cleavages of the coal, in such instances, seldom take place along the surface of deposition; but on igniting the specimen, we may generally obtain partings in those natural seams. I exhibit an example in coal of Hazleton.

The regular slines also, in anthracite, are sometimes so far obliterated as to be only developed by strong heat or partial combustion. They are then shown by the thin, white shining laminæ of earthy matter, which mark two opposite sides of a lump of half burnt coal.

The absolute direction of the cleat is very various. At the Laurel Hill mines, in Hazle creek valley, it is believed to be about north 80° East.

In some beds of coal which I discovered and examined on the West Branch of the Susquehanna, it is due east and west by compass.

In the Middleton mine coal, in the northerly part of England, it is from No. 20° West to No. 32° W.

The second, or "short cleat," in opposition to the "long cleat," which extends for great distances, is the cross parting already spoken of, and not unfrequently runs perpendicularly to the directions of both the "cleavage of the laminæ and to the long cleat." This is seen in both bituminous coals and anthracites.

Another circumstance to which I would refer, as indicative of the similarity of origin and correspondence in character, between bituminous coals and anthracites, is the correspondence of the two, in respect to the composition of the ashes of the two kinds. Silica, alumina, oxide of iron, with small amounts of lime, magnesia, and occasionally of oxide of manganese, are the ingredients of the ashes of both the kinds of coal. The proportions vary, not only in the different kinds of coal, but also in the several plies of the same bed, both in the bituminous and anthracite districts. In the anthracite, the diversity of composition is marked by the colour of the different streaks after partial incineration.

Another resemblance between the two kinds is, that in the anthracite beds, spaces partially vacant are found to contain masses, with a puffy aspect on the exterior, so strongly resembling coke, that it might be difficult at the first glance to distinguish a fragment of it from a piece of artificial coke. Natural coke is also found in connection with beds of bituminous coal, especially where the latter are in close proximity with primitive strata—as in the mines of Virginia.

When coal contains a large proportion of earthy matter, and is deposited in thin laminæ, it will, in the state of anthracite, be found to part with great difficulty in the direction of the surfaces of deposition. It will then be seen to give fractures, developing a multitude of small conchoidal surfaces. This is by the miners termed bony coal; and that it well deserves its name may be evinced by its actually being so hard as sometimes to strike fire with steel.

Coal occasionally assumes the appearance of well defined rhombic prisms and octaedra, occasionally with striated surfaces, in which cases, though the cleavages be difficult and obscure, they are nevertheless practicable.